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(54) Thermally Insulating Container

(57) A relatively inexpensive and lightweight thermally insulating container may be produced either totally or in part from an insulating wall which has been formed by setting or hardening a composition comprising an alkaline earth metal halide, calcium metasilicate, sodium fluorosilicate and/or bentonite, an aluminum silicate clay, sodium silicate, water, an expanded aggregate material and/or reinforcing fibres.

The container is ideally suited for storing valuable matter which needs to be thermally protected such as, for example, magnetic tape and plastics material-based products microfilms, papers and documents. The container may be decorated and may also be provided with handles and/or a lock.

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SPECIFICATION

Thermally Insulating C ntainer

This invention relates to a thermally insulating container which can be manufactured so as to be easily portable and which can be suitable for the storage of such matter as magnetic tapes, magnetised computer media, micro-films, plastics materials, paper and documents.

Most fire-protecting safes and containers presently in use are structured from an asbestos or cement blend "asbestos-lux" as the insulation core inside a metal skin container, the whole container having a calibrated thickness chosen to protect the contents to a desired temperature of from, for exar.iple, 50° to 180°C (the range of distortion or destruction temperatures for valuable materials such as computer tapes, computer discs, microfilm, microfiche and other plastics material or magnetised media, documents, paper records, files, photographs, or other easily destroyed valuables). As a result of the relatively low insulation values provided by th materials used in such containers, the containers have a high density ranging from, for example 40 lbs to 100 lbs per cubic foot of protection casing. Consequently, such containers tend to be very heavy, the weight thereof being dependent upon the degree of internal protection desired and the dimensions of the internal storage cavity Furthermore, the large amount of core insulating material necessary together with the strong outer metal skin which is required increases the cost of the product.

The present invention aims to provide a relatively lightweight, inexpensive and simple means of storing valuable matter such as the aforesaid materials. It is an object of the invention to assist in the provision of a storage means which may be portable if desired or, at worst, significantly less heavy than a similar conventional container.

According to the present invention there is provided a thermally insulated box comprising an insulating wall which has been formed by hardening or setting to a desired shape a composition comprising an alkaline earth metal halide calcium metasilicate, sodium fluorosilicate and/or bentonite, an aluminum silicate clay, sodium silicate, water, an expanded aggregate material and/or reinforcing fibres. The container of the invention may, if desired, be provided with an outer skin, e.g. a skin made of metal. Alternatively, an "inner" skin may be provided. Furthermore, the invention embraces the possibility of only a part of the contain r being insulated by the use of an insulating wall as defined. However, it is preferred that the c ntainer of the invention be made entirely or in major part from an insulating wall as d fined.

The insulating wall in the container of the inv ntion may be constituted by a plurality of panels which may be formed of desired dimensions using conventional tools or, for Patent Specification No. 1,426,375 or French Patent Specification No. 2,342,147. The reader is also referred to co-pending British Patent Application No. 30830/78 and the co-pending British Patent Application filed on 5th February 1980 ntitled "Pre-Mix for Forming a Self-Hardening Composition, Self-Hardening Composition and Composite Comprising the same, Laminate and Insulating Structure made from the Composite and Ingredient for use in any of the aforesaid" in the name of Heit Limited.

Where the insulating wall used in the present container is constituted by a plurality of panels, those panels may be bonded together to form the desired insulating structure by the use of an adhesive agent. A suitable adhesive agent is a paste mixture of vermiculite (exfoliated mica), talc and aqueous sodium silicate solution (preferably containing 20 to 22 parts of water per 100 parts of sodium silicate).

In the present invention, the composition used for making the insulating wall may be made by cold mixing various components to make a pre-mixed composition or bonding compound, that can be inter-mixed with particulate fillers such as expanded perlite, fibreglass, mineral fibres or wools or diatomite to form a paste. The paste can be moulded, pressed or otherwise formed into a desired shape or shapes for the insulating wall using conventional machines. The wall(s) formed therefrom insulate against extremes of temperature but lose no bond strength and emit no toxic fumes when subjected to extreme heat or fires.

The pre-mixed composition used comprises an alkaline earth metal halide (e.g. chloride), calcium metasilicate, sodium fluorosilicate and/or bentonite sodium silicate, an aluminum silicate clay and water. The premix composition preferably comprises 3 to 5 percent by weight of an alkaline earth metal chloride, 0.5 to 1.5 percent by weight of calcium metasilicate, 0.5 to 1.5 percent by weight of sodium fluorosilicate, 30 to 40 percent by weight of sodium silicate, 0.02 to 0.04 percent by weight of an aluminum silicate clay, and water.

The final composition used to make the insulating wall preferably comprises 10 to 35 percent by weight of the ingredients of the foregoing pre-mixed composition, admixed with an expanded aggregate material and/or reinforcing fibres.

The expression "alkaline earth metal chloride" as used herein means $MgCl_2$ or $CaCl_2$ or a mixture thereof, preferably a 1:1 mixture thereof represent d by th formula $CaCl_2.MgCl_2$.

Calcium metasilicate is represented by the formula $CaSiO_3$, whether in the — (pseudowollastonite) or — (wollastonite) form.

Sodium fluorosilicate, silicofluoride or hexafluorosilicate is represented by the formula Na_2SiF_6.

The term "aluminum silicate clay" as used herein includes non-expanding clays, of which

exemplary. However, kaolin is preferred.

"Sodium silicate" as referred to herein is generally represented by the formula Na_2SiO_3 and is also known as water glass (a concentrated solution) or sodium metasilicate. Sodium silicate includes products expressed as having various rati s of $Na_2O:SiO_2$. Typically, in the practice of this invention, sodium silicate is used in the form of a solution in which the $SiO_2:Na_2O$ molar ratio is 1.65:3.9. A preferred sodium silicate has a specific gravity of 1.387 at 499.3 per litre. Solutions of sodium silicate used in the practice of this invention usually contain about 30 to 40 percent of solids, i.e. solutions of above about 34° Baumé will be used. Most preferably, the bonding compositions of this invention will contain 35 to 39 percent by weight of sodium silicate. Therefore, sodium silicate solutions above about 39° Baumé are usually used.

The compositions used to form the insulating wall in the containers of this invention may be made by mixing the solid ingredients of the pre-mixed composition and adding a sodium silicate solution or water as appropriate. The pre-mixed composition or bonding compound is then extended with an expanded aggregate material and/or reinforcing fibre material. Details of methods of manufacture of the compositions used to make the insulating wall in the present containers can be found in the aforementioned Patent Applications (such details are not, however, critical).

"Expanded aggregate material" as used herein includes, but is not limited to, cellular perlite, vermiculite, cellular glass, expanded slag, cellular diatomite and cellular pumice. However, the foregoing are preferred, most preferably expanded or cellular perlite and cellular diatomite.

The expanded aggregate material used in the practice of this invention usually has a particle size of from 150 microns to 4750 microns. However, material mesh of 2400 to 4750 microns is generally preferred. The density of the expanded aggregate materials can be from $2\frac{1}{2}$ to $11\frac{1}{2}$ lb/ft³ (40 to 180 kg/m³), although aggregates having densities of $5\frac{1}{2}$ to $11\frac{1}{2}$ lb/ft³ (90 to 180 kg/m³) are preferred. Preferred sieve size of expanded perlite particles is 3000 to 6000 microns, with particle size (expanded) running from 3mm to 7mm.

"Reinforcing fibres" include, but are not limited to, organic fibres and fibreglass. Fibreglass is preferred owing to resistance to combustion. Organic fibres include natural fibres such as cellulose and wood fibres and synthetic fibres, e.g., from $\frac{1}{2}$ to $1\frac{1}{2}$ inches in length.

In the practice of the invention, the final composition (a paste) may be shaped by extrusion or pressing at 7 to 40 psi or higher pressures to the required insulating wall shape, and predetermined product strength required. Wall products with densities of 10 to 39 lb/ft³ may be obtained in this fashion.

Addition of inorganic viscosity increasing agents, e.g. solium silicate in solution at S:G 1.387 4.864 pounds per U.S. gallon to the final composition or bonding compound up to a level of up to 10 percent by weight will extend the curing time. The curing time can be decreased by the addition of up to 8 percent by weight of inorganic filler, e.g. Kaolin, Diatomaceous Earth, Fine Mica, Vermiculite, Talc etc.

It is preferred that the alkaline earth metal chloride is $CaCl_2$ $MgCl_2$, the aluminum silicate clay is kaolin, the amount of sodium silicate is 35 to 39 percent by weight and the molar ratio $Na_2O:SiO_2$ is 1:1.65 to 3.9.

The present invention provides a method of improving the insulating quality of a container which comprises applying to the container a layer or wall which has been made from a composition as defined above.

The invention will now be further described and illustrated by reference to the following Example.

Example

A number, preferably 4, dry-formed boards made from a composition as noted above (based on expanded perlite particles) are bonded together using a paste mixture of vermiculite (exfoliated mica), talc, and aqueous solium silicate solution (20/22 parts water per 100 parts solium silicate—e.g. as supplied by Joseph Crossfield & Sons Limited) so as to form an open-ended box structure. A further panel is bonded to one open end of the box so that the edges of the panels already used are sealed to the further panel to provide a seal of that end of the box. (Alternatively, the container can be mould-pressed at 10 to 15 psi by any plant or machine that is capable of so-doing.) The resulting box may be provided with a lid by means of a further panel which is fitted to the open top of the box by the use of hinges on one side and a clip or clips or other locking device or retaining device fixed on the leading edge of another side of the panel forming the lid.

Preferably, in order to ensure that there is no smoke or heat leakage between the joins of the box and the join between lid and the remainder of the box when the box is in use, intumescent mastic material such as is supplied commercially by J. W. Bollom & Co. Limited under the name of Isolur may be inserted into a groove to form a continuous ring around the lip of the box and to complete the joints between panels in the box. The groove provided around the lip of the box may, for example, be 1/4" in depth. The groove is positioned so as to ensure that the mastic material is in the centre of the insulating wall regardless of the thickness of the wall. Furtherm re, intumescent paint such as supplied by J. W. Bollom & Co. Limited under the name Broflame may be used to minimise smoke damage by applying this paint to the lip of the box and to the underside of the lid where it rests upon the lip when the box is closed.

The box may be fitted with a locking device on the exterior thereof in order to ensure a firm

closed fit of the lid. Furthermore, carrying handles are usually fitted either onto the lid or onto the sides of the box to enable the box to be moved from place to place.

The entire box may be manufactured to have a weight of no more thkn 15 to 100 lbs depending upon the thickness of the box walls. The thickness of the walls is, of course, dependent on the length of time required for the prespecified protection against fire. This length of time will, of course, also be dependent upon the intended contents for the box, e.g. paper, film, tape or microfiche etc. Thus, by way of example, the following are known breakdown points for various materials which commonly require storage in thermally insulating boxes.

65°C Magnetic tape and similar plastics-based and computer media
93°C Microfilms, microfiches and other such records
121°C Thermoplastic materials generally
135°C Charring to paper
177°C Burning point of paper

Containers as described (the insulating wall being based on expanded perlite particles) have been subjected to fire test as specified by B.S. 476, part 8 (1972). Time and temperature were controlled and measured by an independent recognised authority producing the following results:—

a) A box made from $1\frac{1}{2}$" thick material was capable of protecting paper from charring for approximately 50 minutes.

b) A box made only from 3" thick material was capable of similar protection for approximately one hundred minutes.

c) The material of either box remained sufficiently stable to ensure such physical protection.

Expanded perlite (used as the expanded aggregate material) employed in making the boxes tested was of grade 6JL Coarse as supplied by Tilcon Perlite Products Limited and CPN 100 as supplied by British Ceca Company Limited. It should be noted that the boxes subjected to test were unlaminated, being of single layer structure.

It will be appreciated that the containers of the present invention in general may be docorated in many ways and/or may be provided with external coverings (e.g. laminates) to give additional protection to the container and/or to have a cosmetic effect on the appearance. In a case where the container of the invention is provided by a series of panels made from the composition defined above with no extra skin of, for example, metal, an external laminate material may be provided to ensure not only an attractive appearance to the box but also may protect the insulating wall from knocks or damage during normal use.

A suitable size of box f r the protection of documents etc., is a 2ft cube (a 60 cm cube).

manufactured so as to protect the contents thereof in external temperatures as low as minus 100°C or as high as 1000°C or even more.

Due to the materials from which it is manufactured, the container of the present invention does not (depend upon any other materials incorporated in the container) give rise to toxic gases when subjected to fires.

The present invention of course includes a method of thermally insulating an article, substance or other matter, which method comprises storing said article, substance or other matter in a container of the invention.

Claims

1. A thermally insulated box comprising an insulating wall which has been formed by hardening or setting to a desired shape a composition comprising an alkaline earth metal halide, calcium metasilicate, sodium fluorosilicate and/or bentonite, an aluminum silicate clay, sodium silicate, water, an expanded aggregate material and/or reinforcing fibres.

2. A container as claimed in claim 1, also comprising a container skin optionally made of metal.

3. A container as claimed in claim 1 or claim 2, wherein the insulating wall is provided in the form of a plurality of panels formed from said composition.

4. A container as claimed in claim 3, wherein said panels are bonded together by an adhesive agent.

5. A container as claimed in claim 4, wherein the adhesive agent is a paste mixture of vermiculite (exfoliated mica), talc, and sodium silicate in aqueous solution.

6. A container as claimed in any one of claims 1 to 5 and in the form of a substantially rectangular box with a lid.

7. A container as claimed in claim 6, wherein the lid is hinged to the rest of the box.

8. A container as claimed in any one of claims 1 to 7, wherein the alkaline earth metal halide is magnesium chloride, calcium chloride or a mixture thereof.

9. A container as claimed in any one of claims 1 to 8, wherein the aluminum silicate clay is kaolin.

10. A container as claimed in any one of claims 1 to 9, wherein the expanded aggregate material is expanded perlite particles.

11. A container as claimed in any one of claims 1 to 10, wherein the sodium silicate has a $Na_2O:SiO_2$ ratio of 1:1.65 to 3.9.

12. A c ntainer as claimed in any one of claims 1 to 11, wherein the composition has been formed by mixing a pre-mixed composition comprising the alkaline earth metal halide, calcium metasilicate, sodium fluorosilicate and/or bentonite, sodium silicate, water and the aluminum silicate clay with the expanded aggregate material and/or reinforcing fibres.

13. A container as claimed in claim 12,

35 percent by weight of the pre-mixed composition or of the ingredients thereof.

14. A composition as claimed in claim 12 or claim 13, wherein the pre-mixed composition has been formed by mixing a pre-mix c mprising the alkaline earth metal halide, calcium metasilicate, sodium fluorosilicate and/or bentonite and the aluminum silicate clay with dry sodium silicate and then with water or with sodium silicate solution.

15. A composition as claimed in any one of claims 12 to 14, wherein the pre-mixed composition comprises 3 to 5 percent by weight of the alkaline earth metal halide, 0.5 to 1.5 percent by weight of calcium metasilicate, 0.5 to 1.5 percent by weight of sodium fluorosilicate and/or bentonite, 30 to 40 percent by weight of sodium silicate, and 0.02 to 0.04 percent weight of the aluminum silicate clay.

16. A container as claimed in claim 15, wherein the pre-mixed composition contains from 35 to 39 percent by weight of sodium silicate.

17. A container as claimed in any one of claims 1 to 6 incorporating a lining.

18. A container as claimed in any one of claims 1 to 17 also having an inner core spaced from the insulating wall or walls by an air space.

19. A container as claimed in claim 18, wherein the inner core has been formed from a composition as defined in claim 1.

20. A container as claimed in any one of claims 1 to 19 also provided with external decoration and/or insulating material.

21. A container as claimed in any one of claims 1 to 20, wherein the insulating wall has a configuration such as to provide thermal insulation over only part of the periphery of the container.

22. A container as claimed in any one of claims 1 to 21 provided with carrying handles.

23. A container as claimed in any one of claims 1 to 22 which is lockable.

24. A container as claimed in claim 1 and substantially as hereinbefore described.

25. A container as claimed in claim 1 and substantially as hereinbefore described in the foregoing Example.

26. A method of thermally insulating an article, a substance or other matter which comprises storing said article, substance or matter in a container as claimed in any one of claims 1 to 25.

27. A method as claimed in claim 26 and substantially as hereinbefore described.

28. A method of improving the insulating quality of a container which comprises applying to the container a layer or wall which has been made from a composition as defined in claim 1.

New Claims or Amendments to Claims Filed on 13/4/81

Superseded Claims 14, 15

New or Amended Claims:—

14. A container as claimed in claim 12 or claim 13, wherein the pre-mixed composition has been formed by mixing a pre-mix comprising the alkaline earth metal halide, calcium metasilicate, sodium fluorosilicate and/or bentonite and the aluminum silicate clay with dry sodium silicate and then with water or with sodium silicate solution.

15. A container as claimed in any one of claims 12 to 14, wherein the pre-mixed composition comprises 3 to 5 percent by weight of the alkaline earth metal halide, 0.5 to 1.5 percent by weight of calcium metasilicate, 0.5 to 1.5 percent by weight of sodium fluorosilicate and/or bentonite, 30 to 40 percent by weight of sodium silicate, and 0.02 to 0.04 percent weight of the alumimum silicate clay.

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